Introduction to Robotics					
Course Description		**NHT**			
Introduction to Robotics (IR) is designed to explore the current and future use of automation technology in industry and everyday use. Students will receive a comprehensive overview of robotic systems and the subsystems that comprise them while engaging with a robotics platform. This course is designed for students in grades 9-12 who have an interest in Science, Technology, Engineering, and Mathematics (STEM) and robotics applications.					
Program of Study	**Course Code**				
STEM-Engineering	103194				
	Course Content	**Reference Standards**	**Academic Crosswalk to Common Core Standards**	**Academic Crosswalk to Nebraska Standards**	**Comments**
Standard 1	Students will assemble and use a basic robot for a variety of functions.	REC			
Benchmark 1.1	Apply engineering notebook protocols during robot assembly and use.	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2)
Sample Performan	Research how engineering notebooks are used by engineers.				
Sample Performan	Format an engineering notebook for class activities.				
Sample Performan	Peer review engineering notebook entries.				
Benchmark 1.2	Follow safe procedures.	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.1.d	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performan	Use proper safety when working in the lab.				
Sample Performan	Complete a safety performance assessment.				

Benchmark 1.3	Assemble and use a robot: chassis, drive train, control and power systems.	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.1.d	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performan	Build a basic "square bot" robot.				
Sample Performan	Drive though a maze challenge.				
Sample Performan	Experiment with different driving or control options.				
Standard 2	Students will program a robot to function autonomously.	REC			
Benchmark 2.1	Understand basic programming concepts: structures, variables, constants and logical operators.	REC	ELA.RST.11-12.4	LA.12.1.5 SC.12.1.3.a SC.12.1.3.c SC.12.1.3.d	
Sample Performan	Design a basic program.				
Sample Performan	Describe the effect of changing one component of a program on a robot's performance.				
Benchmark 2.2	Program the robot to travel in a path autonomously.	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.3.a	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performan	Program the robot to travel in a path autonomously.				
Sample Performan	Program the robot to travel in a complex path autonomously.				
Sample Performan	Design a course and program the robot to complete the course autonomously.				

Standard 3	Students will build robots that are functionally and structurally sound.	**REC**			
Benchmark 3.1	Assemble drive trains that utilize different gear ratios to understand mechanical setups.	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 3.1.1	Apply different gear ratios.				
Sample Performance Indicator 3.1.2	Assemble drive trains that utilize different gear ratios to understand mechanical setups.				
Benchmark 3.2	Experiment with forces including: linear motion, rotational dynamics, velocity, weight, frictional coefficients, torque and power.	REC		SC.12.2.2.a SC.12.2.2.b SC.12.2.2.c SC.12.2.2.d SC.12.2.2.e	
Sample Performance Indicator 3.2.1	Construct a ramp and collect data on robot performance.				
Sample Performance Indicator 3.2.2	Determine how much weight a robot will lift.				
Sample Performance Indicator 3.2.3	Describe how gear ratios affect speed and torque.				
Benchmark 3.3	Build a solution to a physics challenge.	REC		SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c	

Sample Performance Indicator 3.3.1	Design your robot to successfully climb a hill (change wheels and other variables to improve performance).				
Sample Performance Indicator 3.3.2	Conduct a class "robot" pull with weight constraints.				
Standard 4	Students will understand closed loop systems by applying sensors to a robot.	**REC**			
Benchmark 4.1	Experiment with closed loop systems with bump sensors.	REC	MTH.G.MG.3	MA.12.2.4.b SC.12.1.3.a	
Sample Performance Indicator 4.1.1	Illustrate how bump sensors work.				
Sample Performance Indicator 4.1.2	Create a system to be turned on/off using bump sensor.				
Benchmark 4.2	Use and understand other sensor systems (ultrasonic, line following, optical speed, potentiometer)	REC	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 4.2.1	Distinguish between various sensor systems.				
Sample Performance Indicator 4.2.2	Analyze the strengths and limitations of different sensor systems.				
Sample Performance Indicator 4.2.3	Apply a sensor system to a robot.				

Benchmark 4.3	Create a robot that can navigate using a closed loop system.	REC		SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d	Alignment presumes that students will design, assess the limits, implement, and evaluate a technical design for a robot that can navigate using a closed loop system (NE: SC.12.1.3.a, SC.12.1.3.b, SC.12.1.3.c, SC.12.1.3.d)
Sample Performance Indicator 4.3.1	Build and program the robot to navigate the system.				
Sample Performance Indicator 4.3.2	Collect data and make modifications.				
Standard 5	Students will create a robot that uses arms and end effectors.	**REC**			
Benchmark 5.1	Understand mass, weight, center of gravity and torque, and how they relate to arms and end effectors.	REC	MTH.N.VM.3		Alignment presumes that students will use geometric models and apply appropriate units and scales to describe the effects of mass, weight, center of gravity, and torque on impact arms and effectors (NE: MA.12.2.4.b, MA.12.3.5.b)
Sample Performance Indicator 5.1.1	Describe how mass, weight, center of gravity, and torque impact arms and end effectors.				
Benchmark 5.2	Understand arm and end effector design.	REC			
Sample Performance Indicator 5.2.1	Describe what happens when a robot picks up and moves an object relative to robot function.				
Sample Performance Indicator 5.2.2	Build a robot to move an object.				

Benchmark 5.3	Complete a challenge by manipulating objects using an arm and/or end effector and a closed loop system.	REC		SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d	
Sample Performance Indicator 5.3.1	Design multiple challenges using student design teams.				
Sample Performance Indicator 5.3.2	Create a competition day involving arm and/or end effector and a closed loop system.				
Sample Performance Indicator 5.3.3	Conduct a ball challenge in which robots compete against one another to move balls to various locations.				